

The claim of the invention is:

1. A method for performing biological assay in a microfluidic biochip platform providing constant and consistent reaction volume defining a reaction zone, the method comprising the steps of:
  - (a) providing a plurality of microfluidic channels with a constant cross-section area;
  - (b) immobilizing at least one biological probe on said reaction zone; and
  - (c) transporting fluid in said microfluidic channels to said reaction zone, a portion of said fluid reacting with said at least one probe, wherein said reaction volume is product of said cross-section area multiplied with length of said microfluidic channels having said at least one biological probe.
2. The method as defined in claim 1, wherein a portion of said microfluidic channels has serpent-like structure, said serpent-like structure overlaying with at least a portion of said reaction zone.
3. The method as defined in claim 1 or 2, wherein said microfluidic channels have dimension between 0.5  $\mu\text{m}$  and 2 mm in cross-section.
4. The method as defined in claim 1 or 2, the microfluidic biochip platform further comprising at least one sample source and at least one reagent solution, wherein a portion of said microfluidic channels is connected to said at least one sample source and to said at least one reagent solution.
5. The method defined in claim 1 or 2, wherein said fluid in said microfluidic channels is moved by a pressurizing mechanism for providing a forward-moving fluid.
6. The method defined in claim 1 or 2, the method further comprising the steps of:
  - (a) immobilizing said at least one biological probe on magnetic beads;
  - (b) transporting said magnetic beads through said microfluidic channels;
  - (c) providing at least one external magnet from magnet sources beneath said reaction zone; and
  - (d) switching on said at least one external magnet to trap said magnetic beads .

7. The method defined in claim 2, wherein said biochip platform further comprises:

- (a) said at least one biological probe immobilized on said reaction zone of a base plate;
- (b) said microfluidic channels patterned on a bottom surface of a top plate; and
- (c) said top plate coupled on top of said base plate.

8. The microfluidic biochip platform according to claim 1 or 2, wherein said probe is protein.

9. The microfluidic biochip platform according to claim 1 or 2, wherein said probe is nucleic acid.

10. The microfluidic biochip platform according to claim 1 or 2, wherein said probe is biological cell.

11. The microfluidic biochip platform according to claim 1 or 2 further comprising an optical detector located above said reaction zone.

12. A method for performing biological assay in a biochip with an array of microfluidic channels providing flexible and controllable immobilization for at least one biological probe, the method comprising the steps of:

- (a) immobilizing said at least one biological probe on magnetic beads;
- (b) selecting at least one of said magnetic beads and transporting said magnetic beads through one of said microfluidic channels;
- (c) providing at least one external magnet beneath a portion of said microfluidic channels; and
- (d) switching on said at least one external magnet for immobilization of at least one of said at least one biological probe.

13. The method defined in claim 12, wherein said external magnets have on and off switching mechanisms for immobilizing or removing said biological probe in said microfluidic channels; and an electronic means for controlling said on and off switching mechanisms.

14. The method as defined in claim 12, wherein said microfluidic channels have dimension between 0.5  $\mu\text{m}$  and 2 mm in cross-section.

15. The method as defined in claim 12, the biochip further comprising at least one sample source and at least one reagent solution, wherein a portion of said microfluidic channels is connected to said at least one sample source and to said at least one reagent solution.

16. The method defined in claim 12, wherein said fluid in said microfluidic channels is moved by a pressurizing mechanism for providing a forward-moving fluid.

17. The biochip according to claim 12, wherein said probe is protein.

18. The biochip according to claim 12, wherein said probe is nucleic acid.

19. The biochip according to claim 12, wherein said probe is biological cell.

20. The biochip according to claim 12 further comprising an optical detector located above said microfluidic channels.